



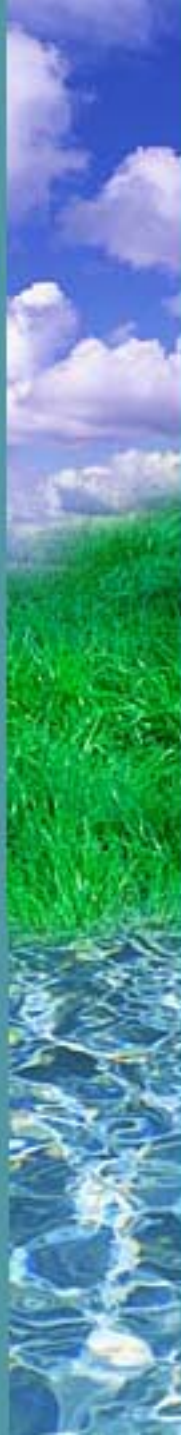
# Why is Unwanted Medicine Disposal a Problem?

Amy L. Perbeck, MPH

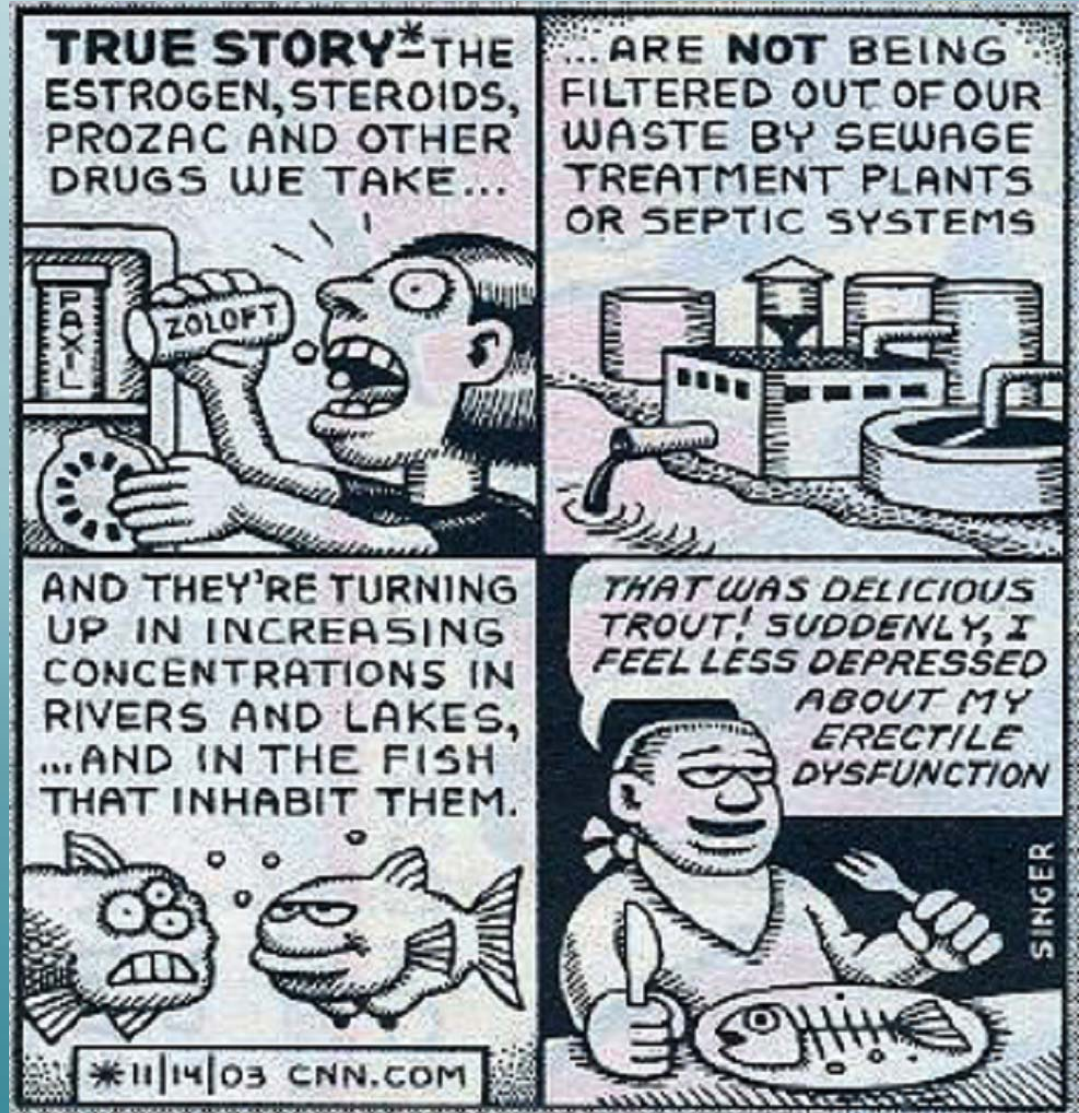
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Quality, Water Bureau

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Unwanted Medicine Disposal: Doing It the Right Way  
April 2, 2008



# Yes, Virginia...





# Points to Ponder

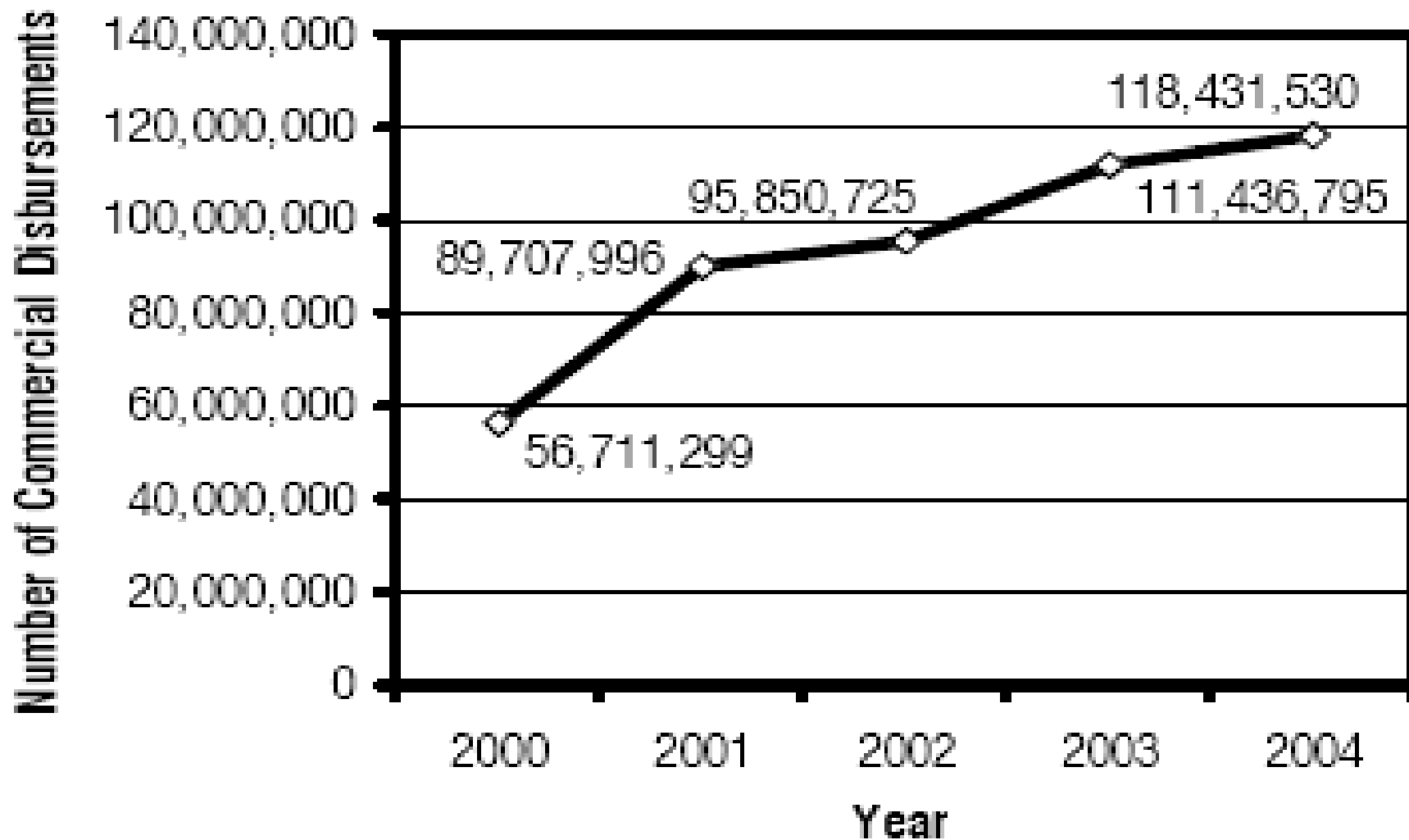
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- Extremely low concentrations
  - Detected only because of improved technology
- Input is essentially constant
  - As is exposure of aquatic organisms
- Complex mixtures of compounds designed to be biologically active
  - Potential additive/synergistic effects
- “Pass-through” suggests resistance to biodegradation
  - Stable throughout manufacture/storage
- Need better fate and transport data to accurately assess impact





# Skyrocketing Drug Sales





# Antibiotic Use

|                            | Europe       | United States |
|----------------------------|--------------|---------------|
| Human Population           | 390 million  | 270 million   |
| Human Antibiotic Use       | 7000 tons    | 4800 tons     |
| Farm Animal Population     | 1.04 billion | 1.96 billion  |
| Farm Animal Antibiotic Use | 3902 tons    | 15100 tons    |



# P-Listed Pharmaceuticals



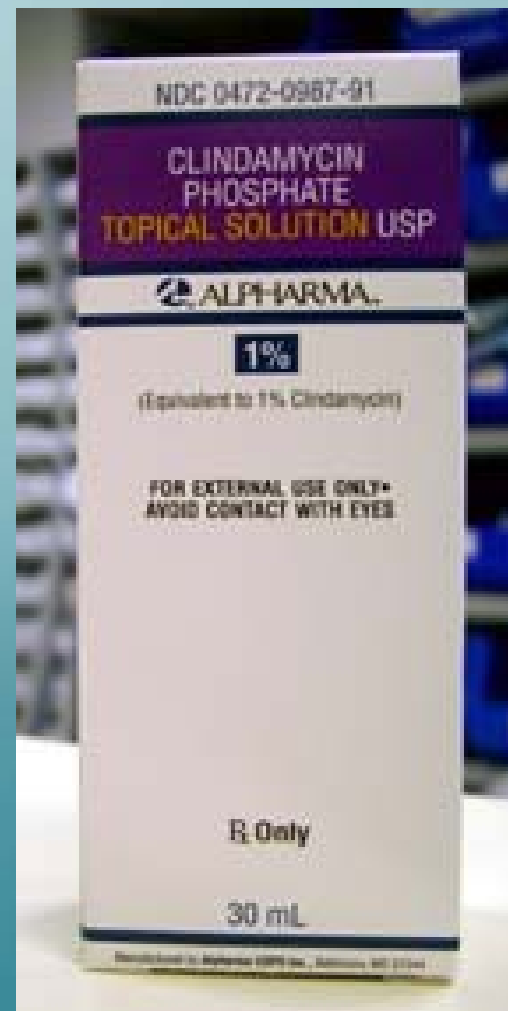


# U-Listed Pharmaceuticals





# “Ignitable” Pharmaceuticals



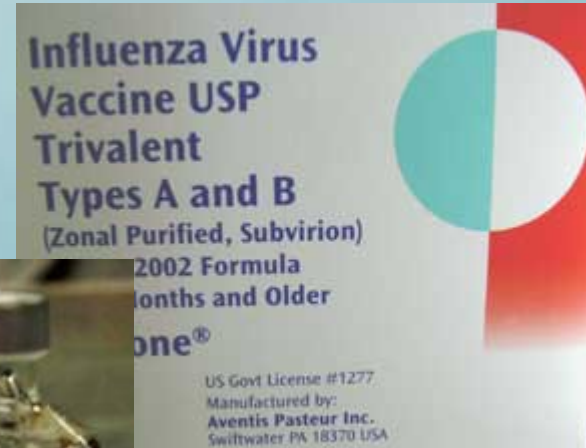




# "Toxic" Pharmaceuticals



**Heavy Metals:  
Selenium, Chromium  
& Silver**



**Preservatives: Thimerosal & M-cresol**

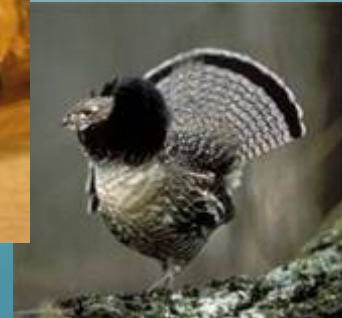


- Medications remain accessible long after their expiration dates
- Used/abused by persons other than the original recipient
  - OxyContin and Vicodin are the prescription drugs most commonly abused by teens



# Improper Disposal

- Accidental poisoning of children, other vulnerable populations
- Accidental poisoning of pets and/or wildlife





# “Old-Fashioned” Disposal

- Flushed to WWTP or on-site system
- Ultimate discharge to surface water and/or groundwater
- Implicated in feminization of male fish
- Overall impact largely unknown







# Who Cares?

- Environmental professionals
  - Effects on ecosystems and resident organisms
- Health professionals
  - Accidental poisonings and attempted suicides
  - Inappropriate dosing
  - Potential impacts on human health from environmental contamination
  - Poor adherence may cost US \$177 billion/year and is associated with 40% of nursing home admissions



# Who Cares? (cont'd)

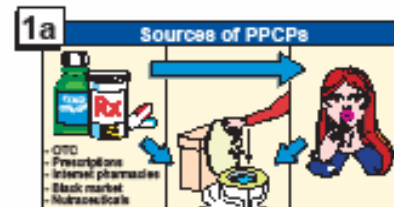
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- Law enforcement
  - Diversion and associated crimes
- Government
  - Waste management costs
  - Wasted health care dollars
  - Increased health care costs
  - Cost of environmental degradation
  - Increased law enforcement costs

# Drug Portal to the World



adapted by Daughton from Ternes (April 2000)



# Origins and Fate of PPCPs<sup>†</sup> in the Environment

<sup>†</sup>Pharmaceuticals and Personal Care Products



U.S. Environmental Protection Agency  
Office of Research and Development  
National Exposure Research Laboratory  
Environmental Sciences Division  
Environmental Chemistry Branch

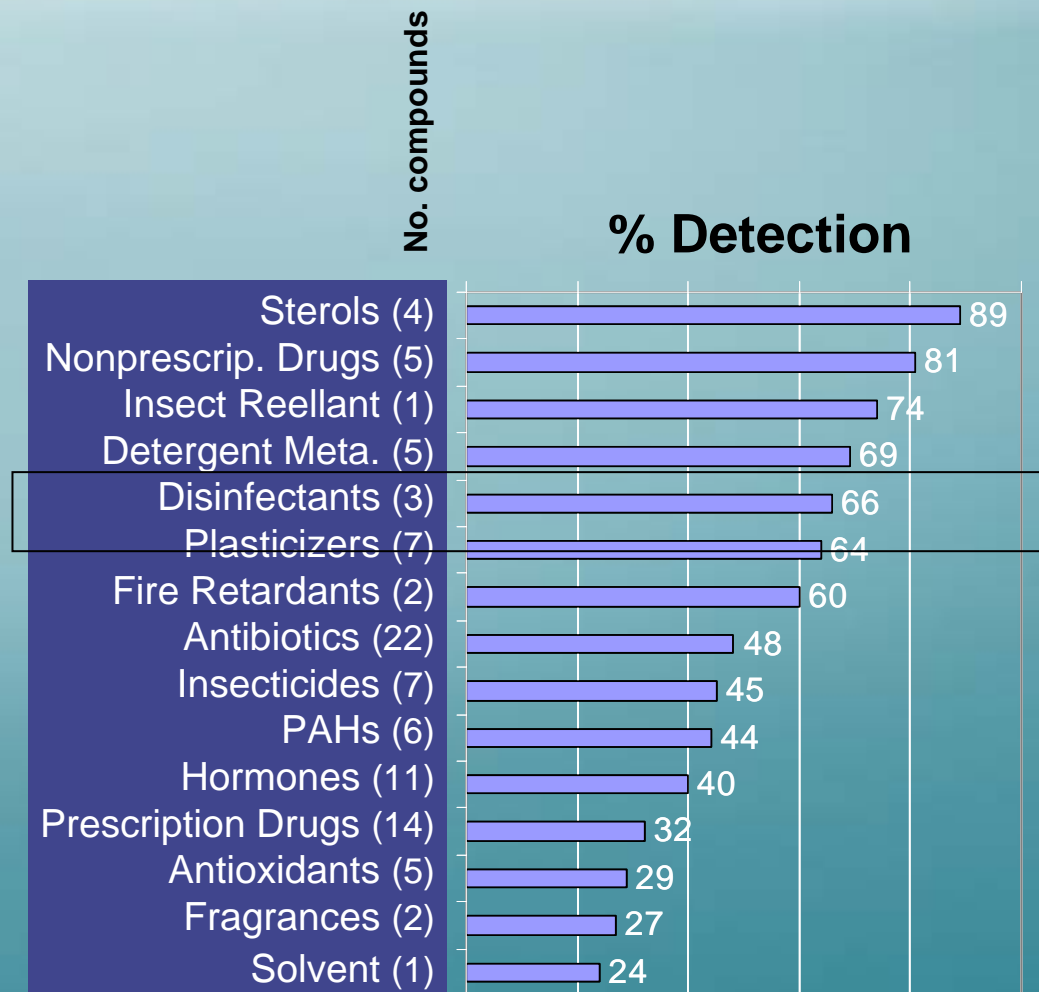






# General Results for Surface Water

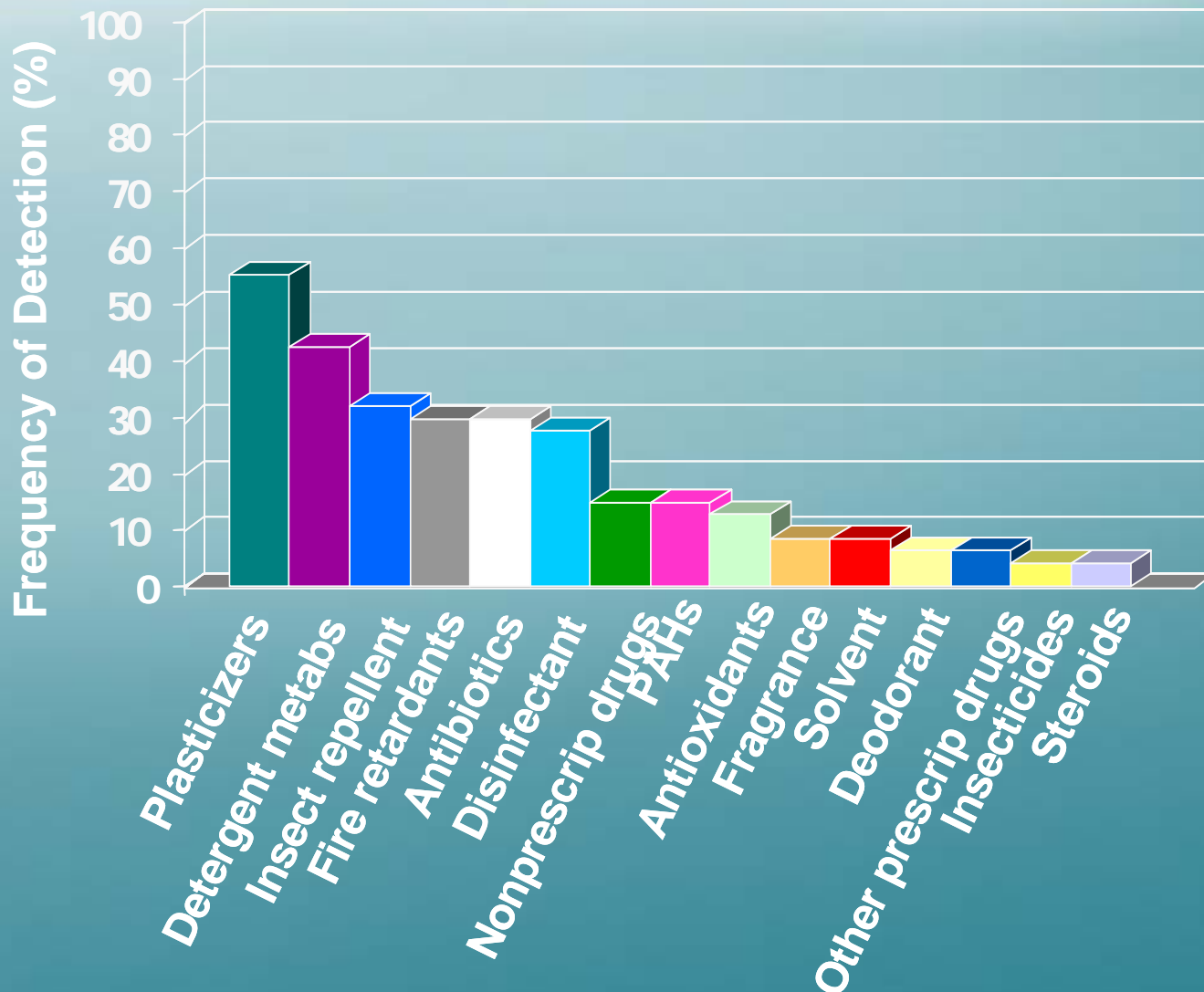
- 82 of 95 compounds detected at least once
- 1 or more compounds in 80% of streams
- As many as 38 compounds per sample
- Only ~5% > 1 ppb
- Total concentration as high as 80 ppb





# Preliminary Groundwater Results

- Detections at ~ 98% of sites sampled
- 45 of 82 compounds found at least once
- As many as 19 found in a given sample



Barnes KK, et al. Pharmaceuticals and other organic wastewater contaminants in groundwater. Sci Total Environ 2008, in press.

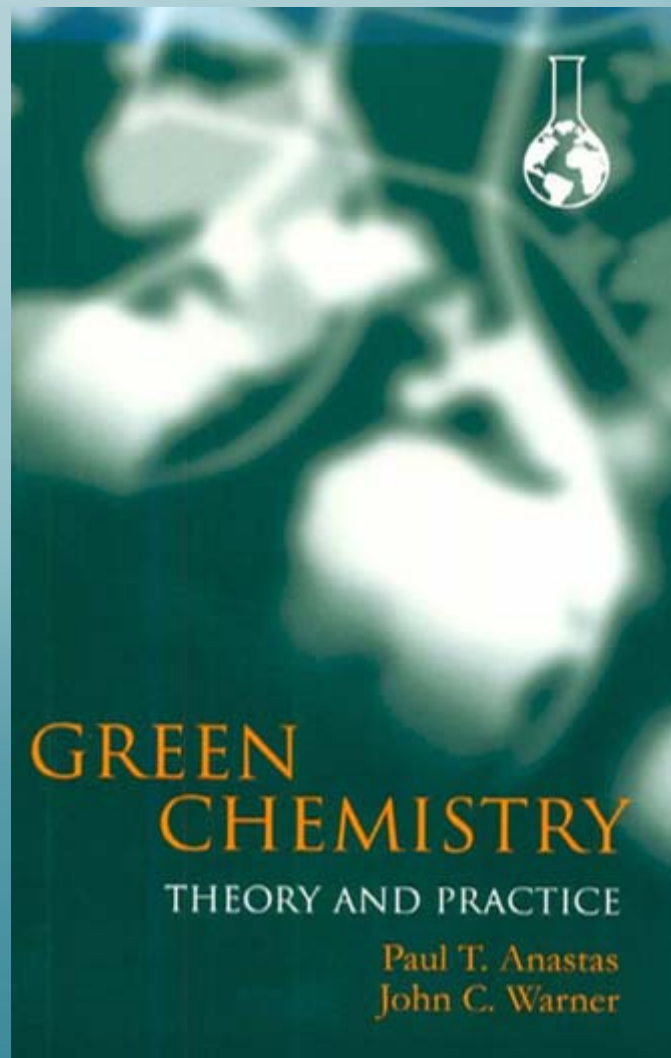


# Aquatic Impacts



- Antidepressants, birth control drugs, other medications detected in fish tissue
  - Causing neurological, biochemical, and physiological changes
- Males with female characteristics found in Potomac, Mississippi, and Colorado Rivers and in Los Angeles/Orange County
  - Also altered sex ratios

- Use less medication
- “Green” drugs (and other products)
- Improved drug delivery systems
- Changes to wastewater treatment facilities







# Disposal Guidance

## A Remedy for Residential Drug Disposal

Managing unused medications is a safety as well as an environmental concern. Traditionally, we were told to flush unwanted medications down the drain or toilet rather than keeping them around so they would not be misused by the patient for the wrong symptoms or by someone else who was not prescribed the medication and who might use the drugs recreationally. Although effective in removing the medication from potentially being misused, flushing creates a new and growing problem in the environment. Antibiotics and other medications in a septic system can destroy beneficial bacteria necessary for the system to operate. Wastewater treatment plants are not designed to remove or process many compounds found in medications that end up being discharged into our surface and ground water. A study by the United States Geological Survey done in 1999 showed that in 80% of the streams sampled contained detectable levels of compounds found in common medications. National attention is growing to develop more appropriate methods of safely disposing of unwanted medications.

NOTE: Information in this fact sheet does not apply to medications generated as waste from Michigan businesses, hospitals, clinics, medical offices, etc. Those facilities should see the *Universal Waste* guidance at [www.deq.state.mi.us/documents/deq-ead-las-univwaste.pdf](http://www.deq.state.mi.us/documents/deq-ead-las-univwaste.pdf).

### What should citizens do with unwanted medications?

Take your medications per the instructions of your doctor or pharmacist. If you do end up with unused medication:

1. **Check with your pharmacy to see if they have a drug take back program.** Some pharmacies are beginning to accept medications back from the public as a community service. Controlled substances (which are often prescription pain killers) can only be accepted under special collection arrangements due to federal Drug Enforcement Agency regulations. Your pharmacy can help identify controlled substances, or see the controlled substances schedules and "drugs and chemicals of concern" at [www.deadiversion.usdoj.gov](http://www.deadiversion.usdoj.gov).

2. **Find out if there is a special collection for unused and expired drugs in your area** by contacting your local household hazardous waste collection or recycling coordinator. A list of local contacts is at [www.michigan.gov/deqreswastecontacts](http://www.michigan.gov/deqreswastecontacts). Controlled substances can only be accepted under special collection arrangements due to federal regulations. Keep medications secure from misuse when storing for an upcoming collection. Commonly collected products include:

- Prescription and over-the-counter medication including cold medicines
- Medication samples
- Vitamins
- Medicated ointments and lotions
- Inhalers
- Veterinary medications



For sharps disposal, see the [The Point is...Needles Hurt](#) brochure and the list of needle and other sharps collection programs at [www.michigan.gov/deqmedwaste](http://www.michigan.gov/deqmedwaste).



## Proper Disposal of Prescription Drugs

Office of National Drug Control Policy February 2007

### Federal Guidelines:

- Take unused, unneeded, or expired prescription drugs out of their original containers and throw them in the trash.
- Mixing prescription drugs with an undesirable substance, such as used coffee grounds or kitty litter, and putting them in impermeable, non-descript containers, such as empty cans or sealable bags, will further ensure the drugs are not diverted.
- Flush prescription drugs down the toilet *only* if the label or accompanying patient information specifically instructs doing so (see box).
- Take advantage of community pharmaceutical take-back programs that allow the public to bring unused drugs to a central location for proper disposal. Some communities have pharmaceutical take-back programs or community solid-waste programs that allow the public to bring unused drugs to a central location for proper disposal. Where these exist, they are a good way to dispose of unused pharmaceuticals.

The FDA advises that the following drugs be flushed down the toilet instead of thrown in the trash:

Actiq (fentanyl citrate)  
Daytrana Transdermal Patch (methylphenidate)  
DuraGesic Transdermal System (fentanyl)  
OxyContin Tablets (oxycodone)  
Avinza Capsules (morphine sulfate)  
Baraclude Tablets (entecavir)  
Reyataz Capsules (atazanavir sulfate)  
Tequin Tablets (gatifloxacin)  
Zerit for Oral Solution (stavudine)  
Meperidine HCl Tablets  
Percocet (Oxycodone and Acetaminophen)  
Xyrem (Sodium Oxybate)  
Fentora (fentanyl buccal tablet)

Note: Patients should always refer to printed material accompanying their medication for specific instructions.

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[www.WhiteHouseDrugPolicy.gov](http://www.WhiteHouseDrugPolicy.gov)

<http://www.deq.state.mi.us/documents/deq-ess-cau-rxbrochure.pdf>

[http://www.whitehousedrugpolicy.gov/drugfact/factsht/proper\\_disposal.html](http://www.whitehousedrugpolicy.gov/drugfact/factsht/proper_disposal.html)